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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/797,888	03/09/2004	Vasile Paraschiv	IMEC312.001AUS	5047
20995	7590	12/28/2005	EXAMINER	
KNOBBE MARTENS OLSON & BEAR LLP			VINH, LAN	
2040 MAIN STREET			ART UNIT	
FOURTEENTH FLOOR			PAPER NUMBER	
IRVINE, CA 92614			1765	

DATE MAILED: 12/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/797,888

Applicant(s)

PARASCHIV ET AL.

Examiner

Lan Vinh

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 March 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-46 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19, 21-41, 43-46 is/are rejected.
- 7) ☒ Claim(s) 20 and 42 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 8/27/2004.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-3, 7, 11-14, 17-18, 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Perng et al (US 2004/0067657A1)

Perng discloses a method for etching HFO₂. The method comprises the steps of:

providing a high k material 20a of HFO₂ on a semiconductor substrate 24 (col 3, paragraph 0022)

contacting the high-k material with a wet etching solution comprising HF, an alcohol/organic compound, sulfuric acid/inorganic acid other than HF (col 2, paragraph 0012, paragraph 0018), the high-k material is selectively etched/removed from the substrate 0013; fig. 2B)

The limitations of claims 2-3, 7, 12 have been discussed above

Regarding claim 11, since Perng discloses the same method using the same materials (high-k dielectric, the etching mixture, silicon oxide) as the claimed invention as per claim 1, under the principle of inherency, the wettability of the organic compound

Art Unit: 1765

in Perng etching solution for the high-k material is higher than a wettability of the organic compound for silicon oxide

Regarding claim 13, Perng discloses using ethanol in a wet etching solution in one embodiment (col 3, paragraph 0021)

Regarding claim 14, Perng discloses that the concentration of solvent/sulfuric acid/organic compound is greater than 50 % (col 2, paragraph 0010)

Regarding claims 17-18, Perng discloses that the etching solution is maintained at a temperature from about 23⁰C to 60⁰ C (col 3, paragraph 0025), which encompasses the claimed ranges

Regarding claim 21, Perng discloses using a surfactant in the etching solution (col 2, paragraph 0012)

3. Claims 23-25, 29, 33-36, 39-40, 43, 45-46 are rejected under 35 U.S.C. 102(e) as being anticipated by Perng et al (US 2004/0067657A1)

Perng discloses a method for etching HFO₂. This method comprises the steps of:
providing a high k material 20a of HFO₂ on a semiconductor substrate 24 (col 3, paragraph 0022)

subjecting the high-k dielectric material to implantation (col 3, paragraph 0023; fig. 2A) since the applicants disclose that implantation causes chemical/physical damage on paragraph 0027 of the instant specification

contacting the implanted/damaged high-k material with a wet etching solution comprising HF, an alcohol/organic compound, sulfuric acid/inorganic acid other than HF

Art Unit: 1765

(col 2, paragraph 0012, paragraph 0018), the high-k material is selectively etched/removed from the substrate 0013; fig. 2B)

The limitations of claims 24-25, 29, 34, 45-46 have been discussed above

Regarding claim 33, since Perng discloses the same method using the same materials (high-k dielectric, the etching mixture, silicon oxide) as the claimed invention as per claim 1, under the principle of inherency, the wettability of the organic compound in Perng etching solution for the high-k material is higher than a wettability of the organic compound for silicon oxide

Regarding claim 35, Perng discloses using ethanol in a wet etching solution in one embodiment (col 3, paragraph 0021)

Regarding claim 36, Perng discloses that the concentration of solvent/sulfuric acid/organic compound is greater than 50 % (col 2, paragraph 0010)

Regarding claims 39-40, Perng discloses that the etching solution is maintained at a temperature from about 23⁰C to 60⁰ C (col 3, paragraph 0025), which encompasses the claimed ranges

Regarding claim 43, Perng discloses using a surfactant in the etching solution (col 2, paragraph 0012)

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

Art Unit: 1765

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5 Claims 4-6, 8-10, 15-16, 26-28, 30-32, 37-38 rejected under 35 U.S.C. 103(a) as being unpatentable over Perng et al (US 2004/0067657A1) in view of Mirkarimi et al (US 6,669,976)

Perng method has been described above. Unlike the instant claimed invention as per claims 4-6, 15-16, 26-28, 30-32, 37-38, Perng fails to disclose the specific concentration of the etchants in the etching mixture/solution

Mirkarimi, in a method for etching high-k material, discloses that the concentration of the etchant can be tailored to provide a desired rate of etching (col 4, lines 50-55).

Mirkarimi illustrates that the concentration of the etchant is a result effective variable

Thus, one skilled in the art at the time the invention was made would have found it obvious to vary the concentration of the etchants in Perng etching solution in view of Mirkarimi teaching to discover the optimum values because it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)

6. Claims 19, 22, 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Perng et al (US 2004/0067657A1) in view of Christenson et al (US 6,835,667)

Perng method has been described above. Unlike the instant claimed invention as per claim 22, Perng fails to disclose that the etching solution has a pH from about -0.5 to about 2

Art Unit: 1765

Christenson discloses a process for etching high-k material comprises of using an etching solution having a pH of 0 to 2 (col 8, lines 4-5)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Perng method by using a etching solution having a pH range as taught by Christenson because Christenson discloses that the pH of the etching solution has a strong effect on the etch rate of high-k dielectric material (col 7, lines 49-50) and the pH of the solution preferably is acidic and may be in the range of about 0 to about 2 (col 8, lines 1-5)

Unlike the instant claimed inventions as per claim 19, 41, Perng fails to disclose that the etching solution comprises HF, HCl and ethanol although Perng discloses using an etching solution comprises of HF and ethanol (col 3, paragraph 0021)

Christenson also discloses that it is possible to adjust the pH of the etching solution downward by the addition of an acid such as HCl (col 7, lines 60-62)

Since Perng is directed to etching high-k dielectric material, one skilled in the art at the time the invention was made would have found it obvious to modify Perng method by adding HCl to the etching solution comprises of HF and ethanol in view Christenson to adjust the pH of the solution downward/decreasing the pH of the etching solution to increase the etch rate of the high-k material (col 7, lines 49-62)

Allowable Subject Matter

8. Claims 20, 42 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



LV
December 20, 2005